DUGWAY PERMIT

MODULE VII

ATTACHMENT 16

HWMU 163
POST-CLOSURE PLAN

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

bgs	below ground surface
CFR	Code of Federal Regulations
Dugway	Dugway Proving Ground
ft	foot, feet
FWEC	Foster Wheeler Environmental Corporation
HWMU	Hazardous Waste Management Unit
mg/kg	milligram per kilogram
msl	mean sea level
NFA	no further action
PCP	Post-Closure Plan
PES	Parsons Engineering Services
PRG	preliminary remediation goal
Shaw	Shaw Environmental, Inc.
SWMU	Solid Waste Management Unit
UAC	Utah Administrative Code
DSHW	Division of Solid and Hazardous Waste
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

The two objectives of this Post-Closure Plan are; 1) to ensure that Dugway Proving Grounds (DPG or Dugway) complies with the Post-Closure Permit issued by the State of Utah in accordance with 40 Code of Federal Regulations (CFR) §264.117, with respect to post-closure inspection requirements; and, 2) outline the requirements needed to prevent exposure or contact with waste left in place at this landfill site. To meet these objectives detailed information regarding the location, regulatory criteria, and post-closure inspections at Hazardous Waste Management Unit (HWMU) 163. The post-closure care period may be extended or shortened, as deemed necessary (40 CFR §265.117(a)(2)).

In accordance with 40 CFR §270.28 and Utah Administrative Code (UAC) R315-3-2.19, the PCP is required to include specific information for a closed facility. As applicable to HWMU 163 at Dugway, the information requirements include:

General description of the facility;
Description of security procedures;
Copy of general inspection schedule;
Preparedness and Prevention Plan;
Facility location information (including seismic and flood plain considerations);
Closure Plan or Closure Proposal;
Certificate of Closure;
Topographic map (with specific scale);
Summary of groundwater monitoring data; and
Identification of uppermost aquifer and interconnected aquifers.

Table 1 provides the regulatory citations for the general information requirements and the specific locations in the PCP where the specific information is presented. Following the table, Sections 2.0 through 10.0 provide the required information in sufficient detail to implement the HWMU 163 PCP.

Table 1: Summary of HWMU 163 Post-Closure Information Requirements Under 40 CFR §270.14, UAC R315-3-2.19 and UAC R315-3-2.5

Regulation Citation	Requirement Description	Location Requirement is Addressed
40 CFR §270.14(b)(1) UAC R315-3-2.5(b)(1)	General Description of the Facility	Section 2.0
40 CFR §270.14(b)(4) UAC R315-3-2.5(b)(4)	Description of Security Procedures	Section 3.0
40 CFR §270.14(b)(5) UAC R315-3-2.5(b)(5)	General Inspection Schedule	Section 7.2, Module VII Table VII-3, and Module VII Form A
40 CFR §270.14(b)(6) UAC R315-3-2.5(b)(6) and UAC R315-8-3	Preparedness and Prevention	Section 4.0

Table 1: Summary of HWMU 163 Post-Closure Information Requirements Under 40 CFR §270.14, UAC R315-3-2.19 and UAC R315-3-2.5 (Continued)

Regulation Citation	Requirement Description	Location Requirement is Addressed
40 CFR §§270.14(b)(11) (i-ii, v) UAC R315-3-2.5(b)(11) (i-ii, v)	Facility Location Information Applicable seismic standard	Section 5.0
40 CFR §§270.14(b)(11) (iii-v) UAC R315-3-2.5(b)(11) (iii-v)	Facility Location Information 100-year floodplain	Section 6.0
40 CFR §270.14(b)(13) UAC R315-3-2.5(b)(13)	Copy of the Closure Plan	Final Closure Certification Report, dated October 13, 2005 for public comment
40 CFR §270.14(b)(14) UAC R315-3-2.5(b)(14)	Closure Certification and Notification	Section 9.0 and Appendix A
40 CFR §270.14(b)(16) UAC R315-3-2.5(b)(16)	Post-Closure Cost Estimate	Federal Facilities are exempt from this requirement
40 CFR §270.14(b)(18) UAC R315-3-2.5(b)(18)	Proof of Financial Coverage	Federal Facilities are exempt from this requirement
40 CFR §270.14(b)(19) UAC R315-3-2.5(b)(19) (i)	Topographic Map Map Scale and Date	Figure 1 (1 inch = 500 feet)
40 CFR §270.14(b)(19) UAC R315-3-2.5(b)(19) (ii)	Topographic Map 100-year floodplain area	Section 6.0; HWMU 163 is not located within a verified 100-year floodplain area; Figure 1
40 CFR §270.14(b)(19) UAC R315-3-2.5(b)(19) (iii)	Topographic Map Surface waters including intermittent streams	Section 2.6 and Figure 1
40 CFR §270.14(b)(19) UAC R315-3-2.5(b)(19) (iv)	Topographic Map Surrounding land uses	Figure 1. There are no residential populations in the vicinity of HWMU 163. The closest residential area is English Village (approximately 20 miles away, see Figure 2).
40 CFR §270.14(b)(19) UAC R315-3-2.5(b)(19) (v)	Topographic Map A wind rose (i.e., prevailing windspeed and direction)	There are no residential populations in the vicinity of HWMU 163. The closest residential area is English Village (approximately 20 miles away). A wind rose is not deemed necessary for HWMU 163.
40 CFR §270.14(b)(19) UAC R315-3-2.5(b)(19) (vi)	Topographic Map Orientation of Map, North Arrow	Figure 1
40 CFR §270.14(b)(19) UAC R315-3.2.5(b)(19) (vii)	Topographic Map Legal boundaries of the hazardous waste management facility.	Legal boundaries have not been established at Dugway for former HWMUs.

Table 1: Summary of HWMU 163 Post-Closure Information Requirements Under 40 CFR §270.14, UAC R315-3-2.19 and UAC R315-3-2.5 (Continued)

Regulation Citation	Requirement Description	Location Requirement is Addressed
40 CFR §270.14(b)(19) UAC R315-3-2.5(b)(19) (viii)	Topographic Map Access control, fence, gates	Section 3.0 and Figures 1 and 2
40 CFR §270.14(b)(19) UAC R315-3-2.5(b)(19) (ix)	Topographic Map Injection and withdrawal wells	Section 2.6 and Figures 1 and 3
40 CFR §270.14(b)(19) UAC R315-3-2.5(b)(19) (xi)	Topographic Map Barriers for drainage or flood control	The surface of HWMU 163 is elevated approximately 3 feet above natural surrounding topography and drains away from the site; Figures 1 and 4.
40 CFR §270.14(c) UAC R315-3-2.5(c)(1)	Groundwater Monitoring Information Summary of Groundwater Data	Not Applicable. Post-closure groundwater monitoring is not required at HWMU 163.
40 CFR §270.14(c) UAC R315-3-2.5(c)(2)	Groundwater Monitoring Information Identification of uppermost aquifer	Not Applicable. Post-closure groundwater monitoring is not required at HWMU 163.
40 CFR §270.14(c) UAC R315-3-2.5(c)(3)	Groundwater Monitoring Information Delineation of the Waste Management Area	Not Applicable. Figure 4; Post-closure groundwater monitoring is not required at HWMU 163.
40 CFR §270.14(c) UAC R315-3-2.5(c)(4)	Groundwater Monitoring Information Extent of Plume	Not Applicable. Post-closure groundwater monitoring is not required at HWMU 163.
40 CFR §270.14(c) UAC R315-3-2.5(c)(5)	Groundwater Monitoring Information Detailed Plans/ Engineering Report for Proposed Groundwater Program	Not Applicable. Post-closure groundwater monitoring is not required at HWMU 163.
40 CFR §270.14(c) UAC R315-3-2.5(c)(6)(i)	Groundwater Monitoring Information Proposed List of Parameters	Not Applicable. Post-closure groundwater monitoring is not required at HWMU 163.
40 CFR §270.14(c) UAC R315-3-2.5(c)(6)(ii)	Groundwater Monitoring Information Proposed Groundwater Monitoring System	Not Applicable. Post-closure groundwater monitoring is not required at HWMU 163.
40 CFR §270.14(c) UAC R315-3-2.5(c)(6)(iii)	Groundwater Monitoring Information Background Values	Not Applicable. Post-closure groundwater monitoring is not required at HWMU 163.

Table 1: Summary of HWMU 163 Post-Closure Information Requirements Under 40 CFR §270.14, UAC R315-3-2.19 and UAC R315-3-2.5 (Continued)

Regulation Citation	Requirement Description	Location Requirement is Addressed
40 CFR §270.14(c) UAC R315-3-2.5(c)(6)(iv)	Groundwater Monitoring Information A description of the Proposed Sampling	Not Applicable. Post-closure groundwater monitoring is not required at HWMU 163.

2.0 FACILITY DESCRIPTION

The following provides a general description of HWMU 163 – The Fire Training Area, as required by UAC R315-3-2.5(b)(1). A general description of the Dugway installation can be found in Attachment 1.

2.1 HWMU 163 LOCATION AND HISTORY

HWMU 163, the Fire Training Area, is located within the Ditto Technical Center area (Figure 3), and lies within the central portion of Government Creek Valley at Dugway, at an elevation of approximately 4,345 feet (ft) mean sea level (msl). It is in an open area immediately east of the Fire Department (Building 4026) and north of Tucker Street, and is approximately 1,650 ft southwest of Solid Waste Management Unit (SWMU) 97 and 1,200 ft east of SWMU 133 (Figure 3). The general direction of surface drainage at HWMU 163 is to the south toward Government Creek.

HWMU 163 consists of the following (Figure 4):

Former fire training pit;
Former fuel drum storage area; and
Former above ground fuel storage tank site.

HWMU 163 was used for fire training exercises from approximately 1978 to 1986, and is no longer in operation. During this operating period, it was used approximately six times for fire training exercises, during which an old car and a number of drums used to simulate an aircraft were placed in the training pit and lit on fire to simulate fire-fighting conditions. Staged metal drums that were arranged in the shape of an airplane were also used in fire training exercises outside of the test pit.

The area that includes HWMU 163 is approximately 400 ft in length (north to south) and 300 ft in width (east to west). When in operation, the fire training pit was at grade and was enclosed by a 12-inch-high dirt berm that was approximately 20 ft in diameter. The former fuel drum storage area is located approximately 200 ft east of the pit and was roughly 10 ft by 40 ft (see Figure 4). The former fuel storage tank was located in the southern portion of the unit, near Tucker Street, south of the pit location. This storage tank consisted of a 500-gallon aboveground tank on a concrete pad that was connected to the training pit by an aboveground pipe. Based on observations from soil sampling and potholing activities during the supplemental site investigation, the site was paved with between six to 12 inches of asphalt. Sometime after 1986, the HWMU 163 site was backfilled with a gravel road base material and graded, and is currently approximately 2.5 to three ft higher than when fire-training exercises occurred. The backfill material covers the area to within 50 ft of Building 4026 and slopes to natural grade. Subsequent activities at HWMU 63 have included construction of an industrial use building.

2.2 PAST OPERATIONS

The training pit was originally lined with plastic and filled with water and JP-4 fuel. The fuel was obtained either from the drums located in the fuel drum storage area, from the aboveground fuel storage tank, or directly from fuel trucks and poured into the training pit. The aboveground fuel storage tank had a 500-gallon capacity, and was connected to the training pit by an aboveground pipeline. Fire suppressants such as Aqueous Fire Fighting Foam (a proprietary mixture) or potassium carbonate dry chemical powder were used to extinguish the fires (FWEC, 1996). The volume of fuel and fire suppressants used at HWMU 163 is unknown. The fires seldom consumed all of the fuel present. The plastic liner was later punctured to drain water from the pit.

2.3 PREVIOUS INVESTIGATIONS DOCUMENTATION

The detailed results of previous soil and groundwater sampling, and closure information including the risk assessment are available for HWMU 163 in the DSHW public documents listed below in Table 2 (UAC R315-3-2.5(b)(13)).

Table 2: DSHW Library Documents Detailing HWMU 163 Investigations

Document Title	Received Date	DSHW Library No.
Ebasco, 1993. *Closure Plans for Solid Waste Management Units at Dugway Proving Ground, Dugway, Utah, Nature and Extent Investigation No. 13 - SWMUs 30, 163, and 170*. August.	8/93	00XXX
Foster Wheeler Environmental Corporation (FWEC), 1996. *Dugway Proving Ground, Draft Closure Plan Module 3, Section 33, Closure Plan for SWMU 163 – Fire Training Area*. September.	9/96	00XXX
United States (U.S.) Army Corps of Engineers (USACE), 1999. *Dugway Proving Ground Closure Module 3, Hazardous Waste Management Unit 163*. Final. January.	1/99	00XXX
Shaw Environmental, Inc. (Shaw), 2005. *Final Closure Certification Report, HWMU 163, The Fire Training Area.* October.	10/05	00XXX

2.4 CLOSURE ACTIVITIES

Dugway has completed closure actions for HWMU 163. The site meets the risk-based closure criteria for future industrial use, as specified in UAC R315-101. The soil in the southern portion of the site along Tucker Street (Figure 4) was evaluated and met the requirements for a No Further Action (NFA) unrestricted residential use closure. Groundwater is not included in the NFA residential use closure. Closure activities performed at HWMU 163 are described in detail in the Final Closure Certification Report (Shaw, 2005). These activities included soil and groundwater sampling. Data were collected from 46 soil borings, 146 surface and subsurface samples, and from five groundwater monitoring wells.

Residual contamination resulting from activities at the site remains in the soil. The lateral and vertical extent of soil impacts at HWMU 163 have been evaluated as presented in the Final Closure Certification Report (Shaw, 2005). Results show that one polynuclear aromatic hydrocarbon (benzo(a)pyrene) was detected at a concentration above the U.S. Environmental Protection Agency (USEPA) Region 9 Residential preliminary remediation goal (PRG) (2004). The lateral and vertical extent of benzo(a)pyrene

is defined. One pesticide (dieldrin) result of the 11 detected in soil samples was above its USEPA Region 9 Residential PRG. The lateral and vertical extent of dieldrin is defined. Three dioxin/furan toxicity equivalents of the eight samples with detections, exceeded the USEPA Region 9 Residential PRG. The lateral and vertical extent of dioxin/furan compounds is defined.

Arsenic was detected in samples at concentrations above USEPA Region 9 Residential PRGs (2004). All 43 arsenic detections exceeded the USEPA Region 9 Residential PRG (0.39 milligrams per kilogram [mg/kg]), and two arsenic sample detections also exceeded the Dugway background value (13 mg/kg). However, based on a geochemical evaluation, the presence of arsenic at HWMU 163 is interpreted to be due to the natural variability in the soils. The occurrence is adequately characterized.

Low level concentrations of volatile organic compounds have been detected in groundwater samples from wells 163-MW03 and 163-MW04. As discussed in Final Closure Certification Report (Shaw, 2005), a mappable volatile organic compound plume cannot be defined due to the inconsistency of volatile organic compounds detected and the infrequency of detections.

The soil and groundwater sample results were evaluated in human health and ecological risk assessments as discussed below.

2.5 HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT

Human health and ecological risk assessments were conducted and indicated that the remaining residual contamination in soil does not pose an unacceptable risk for future workers as defined in UAC R315-101. The cancer risk is less than 1E-04 and the hazard index is less than one based on future industrial use of the property. A risk evaluation was also completed for the southern portion of HWMU 163 to allow the construction of a proposed Fire Department Staging Facility (Figure 4). The evaluations indicated that the southern area meets the criteria for unrestricted residential risk-based closure with a cancer risk of less than 1E-06 and a hazard index of less than one. Ecological risks are expected to be minimal. The human health and ecological risk assessments are presented in the Final Closure Certification Report (Shaw, 2005).

2.6 SURFACE WATER AND GROUNDWATER

The general direction of surface water flow is to the west toward the center of the Great Salt Lake Desert. Surface water in the area flows towards low lying areas to the east, south, and west (Figure 4). There are no permanent standing bodies of surface water in the vicinity of HWMU 163 (Figure 1).

Groundwater monitoring is addressed in the Ditto GMA Plan.

2.7 CLOSURE NOTIFICATIONS

The Certification of Closure (Appendix A) was received and verified by the Executive Secretary of the Utah Solid and Hazardous Waste Control Board on July 2007.

Federal facilities are exempt from submitting notifications to the local zoning authority as required by 40 CFR §§264.116 and 264.119, which are incorporated by reference in UAC R315-8-7.

3.0 SECURITY REQUIREMENTS

HWMU 163 is located within a federal, military installation (Dugway). As such, access to the installation is restricted for the common population. Dugway's Base Security (Range Control) shall monitor access

to HWMU 163.

4.0 PREPAREDNESS AND PREVENTION MEASURES

The Dugway Emergency Response and Contingency Plan (Part B Permit), where applicable to this site, shall be used to announce and respond to emergency conditions.

At a minimum the site inspector should have a radio or phone available during inspections.

5.0 SEISMIC STANDARD

HWMU 163 is not located within 200 ft of any active faults. Although Utah is tectonically active, most of the earthquake activity occurs about 55 miles to the east along the Wasatch Range Foothills.

A geologic map completed in a United States Geological Survey study (Barnhard and Dodge, 1988), was used to determine the distribution, relative age, and amount and extent of surface rupture on Quaternary fault scarps in the area of HWMU 163. This study concluded that morphologic and geologic data collected along the fault scarps in the area indicate that all were formed during the later Pleistocene era and there is not any clear evidence of Holocene surface rupture. Several faults inferred on geophysical evidence are located at Dugway; however, there is no evidence of displacement during Holocene time.

6.0 FLOODPLAIN STANDARD

HWMU 163 is not located within a 100-year verified floodplain. The National Flood Insurance Rate Map, identifying the boundary of the 100-year flood, does not include Dugway. There are no permanent streams or other surface water bodies on Dugway.

Surface water from precipitation flows onto the flat plain and evaporates. Like other arid regions, Dugway is subject to flash flooding following high-precipitation events. Flash floods have occurred only four times in the history of the installation, in 1944, 1952, 1973, and 1983. The major area affected during flash floods has been the Government Creek drainage channel, which has overflowed and caused minor inundation of roads at the Ditto Technical Center.

7.0 POST-CLOSURE INSPECTIONS

7.1 INTRODUCTION

HWMU 163 has been closed under a continued industrial use scenario, which prohibits residential use in the areas formerly occupied by the site. To ensure that the area is not reused or developed for residential purposes, annual general site inspections and a biennial report shall be required. Note that the southern portion of the site has been closed under a NFA residential use scenario. However, this NFA area does not include the underlying groundwater.

7.2 ANNUAL INSPECTIONS

General site inspections of HWMU 163 shall be conducted annually before November, to ensure that the former site remains under industrial use, groundwater wells have not been installed, and to verify the Dugway Dig Permit process as described in Module VII.I has been followed. The frequency of inspections can be modified in accordance with amendments submitted in the Biennial Post-Closure Report. The general post-closure site inspection checklist for industrial use sites should be used and is included in Module VII as Form A. Completed inspection forms shall be filed with the Dugway

Environmental Office. The site shall be visually inspected to ensure the following conditions are maintained at the site:

1 There is no evidence of land use other than for industrial purposes within the former site boundary; and
2 There is no evidence of soil disturbance other than that authorized by the Dugway Environmental Office.

Table 3 summarizes the Post-Closure Inspection Schedule for HWMU 163, and lists the items to be inspected and potential problems. Inspection personnel shall note any problems found and shall inform appropriate Dugway representatives.

Table 3: HWMU 163 Post-Closure Inspection and Monitoring Schedule

Inspection/Monitoring Item	Method of Documentation	Frequency of Inspection
Land Use	General Post-Closure Site Inspection Checklist (Module VII Form A)	Annual inspections shall be conducted no later than November 1st of each year.
Soil Disturbance (other than that authorized by the Dugway Environmental Office)	General Post-Closure Site Inspection Checklist (Module VII Form A)	Annual inspections shall be conducted no later than November 1st of each year.

7.3 INSPECTION FOLLOW-UP

Copies of completed site inspection checklists (Module VII Form A) shall be forwarded to the Dugway Environmental Office. The Point-of-Contact for the Dugway Environmental Office is as follows:

Environmental Programs Compliance Representative
Dugway Proving Ground Environmental Program Office
Dugway Proving Ground, UT 84022
Telephone: (435) 831-3560

The Dugway Environmental Office shall notify the appropriate personnel to implement corrective action as needed.

Corrective action shall be initiated as soon as practical after identifying the problem, or as directed by Dugway. If the corrective action requires substantial effort, a technical plan shall be prepared to summarize the problem, the potential impacts, the proposed plan for action, and the time-frame in which corrective action shall be implemented as required under this Permit. This plan shall be approved by the Executive Secretary and shall be submitted within 30 days of Dugway's decision to implement corrective action.

8.0 SUBMITTALS/REPORTING

Based on the evaluation presented in Final Closure Certification Report for HWMU 163 (Shaw, 2005), no post-closure monitoring, including groundwater monitoring, is required for HWMU 163.

8.1 NON-COMPLIANCE REPORTING

The conditions at HWMU 163 are such that the impact to human health and the environment is very unlikely. Hazardous wastes are no longer managed or maintained at the site. Nonetheless, if there is any type of non-compliance with any condition of this Permit, notifications shall be submitted per Permit Condition VII.C.5.

8.2 BIENNIAL POST-CLOSURE REPORT

In accordance with UAC R315-3-3.1(l)(9), a Biennial Post-Closure Report shall be prepared for all Dugway closed HWMUs and SWMUs undergoing post-closure care by March 1st of the reporting year. The first Post-Closure report for HWMU 163 shall be due by March 1, 2007. After this initial period, reporting years shall change to odd numbered years, with subsequent biennial reports due by March 1st of even numbered years, beginning in 2008. Specifically for HWMU 163, the Biennial Post-Closure Report shall include, at a minimum, the following:

- General site description and conditions; and
- Inspection records.

8.3 REQUIRED SUBMITTALS

Table 4 summarizes the requirements for the Biennial Post-Closure Report for HWMU 163 and reporting for any non-compliance.

Table 4: Summary Table of Required Submittals

Required Submittals	Frequency and Submittal Date
Biennial Post-Closure Report	Post-Closure Reports shall be submitted to the Division of Solid and Hazardous Waste no later than March 1st of the year the report is due. Reporting years are even numbered years beginning with 2006 and odd numbered years beginning 2007 for the duration of the Post-Closure Monitoring Period.
Non-Compliance Reporting 1) Anticipated Non-Conformance; 2) 24-hour Notification for information concerning the non-compliance, which may endanger public drinking water supplies or human health or the environment; 3) Five-day written notification for information concerning the noncompliance, which may endanger public drinking water supplies or human health or the environment. The Executive Secretary may waive the 5-day notice, in favor of a 15-day notice; and 4) Written notification for information concerning the non-compliance, which does not endanger human health or the environment.	1) 30 days advance notice of any change which may result in non-compliance; 2) Orally within 24 hours of discovery; 3) Within 5 days of discovery; and 4) Submitted with the Biennial Post-Closure Report.

9.0 POST-CLOSURE CERTIFICATION

No later than 60 days after post-closure activities are completed and approved by the Executive Secretary, Dugway shall submit a certification to the Board, signed by Dugway and an independent professional engineer registered in the State of Utah, stating why post-closure care is no longer needed.

10.0 REFERENCES

Barnhard, T.P. and R.L. Dodge, 1988. *Map of Fault Scarps Formed on Unconsolidated Sediments, Tooele 1^{o} x 2^{o} quadrangle, Northwestern Utah*, United States Geological Survey.

Ebasco, 1993. *Closure Plans for Solid Waste Management Units at Dugway Proving Ground, Dugway, Utah Nature and Extent Investigation No. 13 -SWMUs 30, 163, and 170*. August.

Foster Wheeler Environmental Corporation (FWEC), 1996. *Dugway Proving Ground, Draft Closure*

Plan Module 3, Section 33, Closure Plan for SWMU 163 – Fire training Area. September.

Parsons Engineering Services (PES), 2004. *Hydrogeological Assessment and Regional Groundwater Management Plan, Volume I: Ditto Groundwater Management Area*. Final. October.

Shaw Environmental, Inc., 2005. *Final Closure Certification Report for HWMU 163, The Fire Training Area, Dugway Proving Ground, Utah*. October.

U.S. Army Corps of Engineers (USACE), 1999. *Dugway Proving Ground Closure Module 3, Hazardous Waste Management Unit 163*. Final. January.

U.S. Environmental Protection Agency (USEPA), 2004. *Region 9 Preliminary Remediation Goals*. Washington, D.C. October.

HWMU 163
CERTIFICATION OF CLOSURE

APPENDIX A

FIGURES

HWMU 163